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Capitalization in Canadian Agriculture: Understanding the Issues and the Evidence

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1. Introduction

A feature of modern agricultural industries is continuous decreases in aggregate real farm incomes. In Canada, real net income in agriculture declined by 80% looking only at the years 1973 to 2003. Changes in net farm incomes in the United States, United Kingdom and France have been only modestly less dramatic during this same time period (Figure 1). Although net cash farm income in Canada has been trending upwards in nominal terms, in real terms it peaked in 1975 and has continued its long-term downward trend (Figure 2). Realized net farm income (after adding income-in-kind and subtracting depreciation from net cash income) has shown a long-term downward trend in real terms but fairly constant levels in nominal terms – except for 2003 when the discovery of BSE helped to push net farm income to a record low level (Figure 3).

At the same time, the value of farm capital has been increasing. Between 1928 and 2003, the value of land and buildings in Canada has risen from about $70 million to about $200 million (in constant 2003 dollars); see Figure 4. Although the value of farm assets has been increasing, the value of land and buildings has remained at about 70% of the value of total assets (except for a short period in the late 1970s and early 1980s when land prices spiked). During the same time period, the value of machinery and equipment has constituted about 15% of farm assets.

It seems counterintuitive that the value of farm assets has been increasing in real terms while net incomes have been decreasing in real terms. Even if real net incomes have been largely flat on trend, it is surprising on the surface to see real farm asset values increasing. It is well-known that agriculture in a developed country is a capital-intensive business but there is an issue about how highly priced some of the capital assets become and how farmers' own actions affect this valuation process. The major objective of this paper is to explain why this has continued to occur.

One element of this valuation process concerns the price of farm land and other inelastically-supplied assets such as farm marketing quota. When there are profits in a farming activity, the combination of free entry (competition) and the restricted supply of these inputs results in their prices being bid up in a process referred to as capitalization. This has been a much studied concept, especially where it has concerned profits generated by government programs. There is an interest by policy economists in the effects of this process of capitalization because it can alter the distributional effects of government policies and changing farm market conditions. There has always been a concern about how this process may enrich those farmers who are leaving the industry and how it may impose a heavy tax on those entering.

In the second section of this paper, the theory of capitalization is presented and discussed. The present value pricing model has been a much used analytical method to study values of capital assets. The theoretical foundation for this type of study rests on assets, such as land, providing an annual stream of net benefits, similar to returns from investing in a bond. An investor would be prepared to pay a price to obtain this stream of future income and the price would depend, in part, on the opportunity cost of the capital required, e.g., the interest rate. For a given stream of income, a higher interest rate would reduce the relative value of the income stream and, hence lower the price an investor

would be willing to pay for it. The present value pricing model, a quantitative estimation formula that is much used in finance and real estate theory, has also been applied to studies of agricultural land markets. Empirical studies have investigated the effects of various factors on land prices, including market prices of agricultural output, scale economies, government subsidies, price supports or guarantees, tax policies, and the risks associated with changes in government policy. The major results of these studies are discussed in the latter part of the second section.

Some parts of the literature raise questions about the applicability of standard present value theories of capitalization, citing empirical results that show contradictory results. There are a variety of issues involved in applying the present value model that require consideration and these issues, primarily regarding measurement and application, are investigated and discussed in the third section of this paper.

The fourth section features a closer examination of the data on net farm income and capital values. Drawing on the capitalization literature, and the theoretical and measurement issues outlined in sections two and three, we re-evaluate these data to understand better what is occurring in farm capital markets.

The fifth and final section summarizes the major findings of this study. It would be surprising if any single estimation technique could explain the level and variability of prices of a specialized asset like land, each lot of which has unique characteristics. However, an understanding of the theoretical foundations of various pricing models and their application in empirical studies can lead to improved understanding of the role of economic variables within and outside the agricultural industry. Further study on farmland values in Canada is needed and we make some suggestions for this research.

2. Theory of Capitalization

2.1 Net Present Value Model

This widely used model can be complicated in many ways but at its simplest is expressed as the following formula that explains the relationship between values of assets and net income, mediated by the real interest rate.

$$V = R/r \qquad (1)$$

where: V is the value of a capital asset
R is the expected annual net return from the asset, and
r is the expected real rate of interest.

This simplified version is applicable if the annual return accrues for an infinite number of years. If the returns occur for only a limited number of years, the formula becomes more complex,

$$V = \Sigma \, (R/(1+r)^t) \qquad (2)$$

where the summation occurs with t running from period 1 to N. To make this model more general still, the R value can be subscripted to take on a value for each period t, but as this model often is used empirically, the R value is taken to be constant. An intermediate variant of this is where capital gains are allowed, which can be considered as R growing at some rate g or where the value V increases at rate g. In this case, the denominator expands to (1+r-g). In the version where N is infinite, where the returns are expected to go on into the distant future, the model with capital gains simplifies to

$$V = R/(r-g). \qquad (3)$$

If one is willing to accept constant annual returns, R, constant discount rate and rate of capital gain, and an infinite time horizon, this model would serve as a useful starting point. This might be considered the case for valuing assets based only upon market returns, like land values when there were no government policies.

However, if there are government policies involved that generate income flows, capitalization of these additional income flows are likely to involve an additional factor, what is often described as policy or default risk. This can be considered in a simple fashion as augmenting the discount rate by a policy risk parameter, but in Barichello (1996) it is formulated in a way that transforms the valuation formula to

$$V = R(1- d)/(r + d - g) \qquad (4)$$

where d is the risk of a default in the government program that would cause the value of R to go to zero.

Any increase in R, the expected net annual returns, would increase V, the value of the asset. This would include an increase in gross market income, holding input costs constant, or a decrease in input costs holding gross returns constant. Also included in R is any net benefit from government programs that would increase net income on this enterprise. Similarly, an increase in the expected capital gains from the asset would raise V, one interpretation of which is an increase in the expected rate of growth of net returns, R. A decrease in the real interest rate r would raise the value of the asset. Also, a decrease in the expected rate of default of the government program contributing to net returns would raise the price of the asset.

There are multiplicities of ways in which this basic model can be made more complex but we will reserve a discussion of those to the review of the literature. The main point here is that even before choosing appropriate empirical magnitudes for applying this model, any of models (2) to (4) are more complicated than model (1). Furthermore, there can be government program changes or market changes that alter profitability of the commodity that may not be captured in the usual measures of net returns or the interest rate.

When it comes to finding the appropriate empirical variables, the underlying model uses expected values, not the current market value in any one period. This might prove to be a difficult matter to deal with. And the measure of net returns may be unobservable. This is commonly true in quota-constrained markets where the normal

market clearing condition of price = marginal cost does not apply. Or there may be additional components to net returns in addition to market price, such as tax benefits that should be included, or even non-farm net returns.

These several factors bedevil the empirical application of the net present value model. As is shown in the following section, several empirical attempts to model land market prices using a simple net present value framework have not led to useful results. After the discussion above, this should come as no surprise. Even examining quota values, where there is no alternative value of this asset aside from its value in farming, the valuation process, although basically a net present value process, is more complicated than the simple version of equation (1). We now examine in more detail those empirical applications.

2.2 Empirical Studies of Capitalization in Agricultural Asset Markets

There are a large number of studies that examine agricultural asset markets, mostly land markets, to determine if there is any evidence of the capitalization of the benefits of government programs.[1] Most of these studies have focused on United States farmland markets but there are at least a dozen studies that use Canadian asset value data, as well as numerous similar studies in the European Union, Australia, and New Zealand. The models and empirical methods vary but most of these studies begin with what has become the standard model in this literature, a net present value model of asset pricing.

The clear conclusion from these studies is that the benefits of government programs generally become capitalized into the value of an asset, usually farm land but sometimes quotas or allotments (in the case of tobacco). These assets have the common feature that they are in relatively inelastic supply. However, the process is more complex than that found in simple models, leading to a substantial amount of debate on related issues. Most of these studies have concentrated on studies of farm land prices due to its widespread importance but several have examined the capitalization process from production quotas.

Among the earlier papers on farmland values during the 1960s and 1970s, a present value approach along Ricardian lines was common, as was a supply-demand approach for farm land. However, as later studies used data from the 1970s when farm land prices were booming, creating a divergence between current income and land values, followed by the early 1980s when land prices fell dramatically, the earlier models failed to track land values well (Pope *et al*). This led to a re-examination of the various land price models, including the present value model. Most modifications followed the general principle that farmland values reflected net returns, but broadened the notion of what were included in net returns and relaxed some of the assumptions of an overly simplified version of the present value model.

Broadening the set of factors that should be included in net returns focused on the larger number of explanatory variables that could contribute to land values that should be in these models. One of the most important was the factor of capital gains (Melichar,

[1] A detailed review of numerous studies to 1994 is included in Turvey et al (1995).

1981). This is equivalent to allowing the annual net returns, including but not restricted to land rents, to grow in real terms over time. Alston (1986) raised the important issue of after-tax net returns being the critical factor, not just the returns before taxes. This is particularly relevant to capital gains because usually capital gains income is taxed at lower rates than are annual income flows. Feldstein (1980) broadened the role of land to an investment asset, not just a production asset, raising the issue of land returns relative to equity and bonds in a portfolio. This led to introducing inflation as a potentially important variable, not only due to differential taxes on capital gains but because inflation affects the real returns to different classes of capital differently. A fourth important contribution during the 1980s was that of Burt (1986), emphasizing the importance of long run considerations, that expectations on net returns are important, and that the relevant discount rate is the long run real rate, not for the most part a varying annual rate.

Another class of factors that has been introduced is that of non-farm returns to land. These could be important in those agricultural areas adjacent to urban centers where the demand for urban land (residential, commercial and industrial) could affect farmland prices. In Canada these factors may be relevant in parts of Ontario and in the Lower Fraser Valley area of British Columbia where urban factors may partially determine the price of farmland. In the larger picture, vast areas of farm land in Canada and the United States are outside the influence of urban factors, leading aggregate (national) studies of farmland prices to usually show little or no influence from urban variables. Some of the factors that have been introduced have been shown to have no important role at the market level or higher, such as debt and credit rationing.

A different strand of empirical tests of net present value models of land prices arose in the late 1980s and early 1990s using time series data and cointegration procedures. This approach is statistical but raises the question of whether the estimated regression relationship between annual returns and asset values is spurious. It draws on the Engle and Granger (1987) concept of cointegration between a dependent variable (e.g., the land price) and a set of explanatory variables in the situation where the data are characterized by unit roots. Campbell and Shiller (1987) applied this to present value models showing that if the present value model is correct, net rents and land prices should systematically react (or error-correct) to deviations from a linear long run relation characterizing the present value model. Such tests were imposed on farmland data in a variety of studies, including several in Canada (e.g., Clark, Fulton and Scott, 1993), and most studies concluded that the simple present value asset pricing model did not hold. There are a number of reasons why this result could be obtained, including that the present value model that would be expected to work in actual data would be more complicated than a simple net annual farm returns and farmland price relationship, as has been discussed above in our own version of this model and in the literature already summarized. For example, the net returns could include more than annual farm rents (including capital gains not derived from annual farm rents, non-farm returns, or other benefits not measured in farm rents), the discount rate could vary over time (due to policy or default risk as one factor), and there could be speculative bubbles where the normal price/earnings ratio varies for other reasons such as those associated with booms and busts in asset prices where the usual fundamentals related to returns and interest rates do not appear to apply.

Focusing more on government programs and their effects on asset prices, there are a small number of papers that report on estimations of quantitative effects on land prices from changes in government support programs. Some of these are simulation models while others measure the effects on land prices more directly. The results are also quite variable by policy, country and time period. Veeman, Dong and Veeman (1993) estimated that the abolition of direct government transfer payments in Canada would lower land prices by 18 percent in the long run. Goodwin and Ortalo-Magne (1992), using wheat data from six regions across France, the United States and Canada estimated a 1 percent increase in Production Subsidy Equivalents would raise land prices by only 0.38 percent. Just and Miranowski found that United States government payments account for 15-25 percent of the value of land but that changes in such payments have had little effect on annual changes in land prices. Turvey et al (1995) found provincial differences in the effects of government programs on land prices. Land prices in Ontario were more responsive to market income than to government payments, whereas there was little difference in Saskatchewan. In both cases, a 1 percent increase in government payments would lead to an inelastic (0.5-0.6 percent) increase in land prices.

This issue of possibly differing discount rates between market income and government payments is an example of the more specific questions that have been raised in capitalization studies in the past decade. Clark, Weersink and Sarkar (2002) found that contrary to the Turvey et al (1995) results, discount rates in Saskatchewan and Ontario were not significantly different. And they also found that, contrary to Weersink et al (1997), there was no statistical difference in the discount rate between market and government payment income in land prices in these two provinces.

Goodwin, Mishra and Ortal-Magne (2004) found, in a broad-ranging paper, that using expected returns produced better results than using actual returns, but that with expected returns, an extra dollar of government payments increased land prices by more than an extra dollar of market returns, the reverse of what was found for actual returns. They also found that land values increased differently depending on the type of government program, and that tenants (leaseholders) get some benefits of government programs, although less than half, until lease rates and contracts are revised. Kirwan (2004) also found that leaseholders get a significant share of government subsidies, more like 60 percent, but this too is a short run response, subject to some reduction when lease rates and contracts would be revised over time.

Moss (1997) found that inflation rate was the single most important determinant of farmland prices in the 1960-1994 period, in contrast to Feldstein's earlier result. Plantinga et al (2002) studied the importance of urban land development in influencing farmland prices, but this depended on the proximity to urban centers. Near rapidly developing areas, future development rents account for more than half the agricultural land values, but in major agricultural regions like California's Central Valley, the figure was only 5 percent.[2]

[2] We have neglected the large body of research that uses hedonic approaches to value the various characteristics of individual land parcels which is a common and productive avenue of research when using micro data on individual transactions in a cross section. Our focus is more on aggregate time series data.

The benefit of tax advantages and its role in agricultural asset prices has rarely been measured. One case where an attempt was made to value the benefit from a tax saving was undertaken for quota purchases in Canada (Barichello and Glenday, 1985). The tax provision allows for a depreciation calculation[3] to be undertaken on new quota purchases, but any depreciation used must be "recaptured" upon sale of that quota. In essence, this provision gives the quota purchaser an interest free loan from the Government of Canada for as long as the quota is held. Although this is an advantage, it works out in present value terms to be a small factor in the total profitability of a quota purchase, less than three percent of the quota's value.

Finally, Sumner and Wilson (2004) showed for California dairy quota that default risk is not only important in the market for that asset but that it is much more significant in size than the more normal portfolio risk prominent from capital asset pricing models.

2.3 Summary of Empirical Studies

The lessons from this literature can be summarized as follows. First, farmland values reflect the net returns from that asset. However, net returns include market returns, government payments, and other returns not included in those two factors, often due to government policies. One example of such "other" returns could be insurance benefits in cases where the government program may reduce the volatility of net income of farmers, or it could be tax benefits. Expected returns are usually more relevant than actual received returns. Capital gains can be highly important, although they are usually a reflection of an expected increase over time in future returns to the asset. This would include new quantity allocations of quota which can be seen as a type of capital gain in addition to traditional asset price-based capital gains. Nonfarm factors, such as returns from urban development, re-zoning, or changes in environmental regulations, can be important but usually are most relevant in regional markets near growing urban areas.

Second, risk is an important consideration in asset purchases. This is because of "portfolio risk",[4] and default risk,[5] although the latter appears to be much more important in the case of dairy quotas (Sumner and Wilson, and Barichello, 1996). These risk factors can vary over time due to changing perceptions of the likelihood of changes in government policies. Because they are embedded, and often not observed directly, in the discount rate, these factors usually are the key variables responsible for what are referred to in this literature as changes in the discount rate. The interest rate (the private opportunity cost of capital) is also a component factor in the discount rate and can be important, although it is relatively small compared to default risk factors (e.g., long run real interest rates are in the range of 5 percent whereas default risk can add up to 25 percentage points to that risk (Sumner and Wilson; Barichello 1996). These discount rates may differ depending on whether the income is from market sources or government

[3] Accountants often compare this capital cost allowance on "eligible capital" to a similar treatment of "good will" in other businesses..

[4] This is the standard concept of risk from the capital asset pricing model in the finance literature where the risk premium demanded is measured as the contribution of that investment to the future variability of the investor's whole portfolio of assets (Sumner and Wilson).

[5] The risk that some negative effect on the whole system of returns will reduce or remove the stream of income due to that asset, sometimes referred to as policy risk when it is a change in government policy that will lower the income flow (government policy-related payments) accruing to that asset.

payments. No clear rule is evident on this issue. Which discount rate is higher depends on the empirical situation, on the details of the government program, and the context of normal market returns.

The effects of government programs on capitalization vary considerably across those programs. Different programs have different current and future net benefits, different expected time horizons (permanent versus transitory), and are implemented in different market situations.

Finally, the incidence of government program benefits may differ according to the situation. Not all program benefits seem to be capitalized into land values. Some benefits remain with renters, particularly in the short term until rental contracts can be adjusted, and in some cases there have been legislative attempts to impose benefits for tenants (e.g., distributions of government payments at the conclusion of the Western Grain Transportation Act).

2.4 Capitalization and Quota Values

Most of this capitalization literature as discussed above applies to land values. There is a separate smaller literature applying to capitalization of the benefits from production or marketing rights, usually some kind of quotas or similar mandatory controls..

Here the farm quota asset takes on only the value of the net returns being generated by the asset, because, unlike land, quotas do not have consumption values or the values of other characteristic associated with them, such as site values, non-farm returns and the value of land as a portfolio asset vs a productive asset. All the net returns associated with the quota come from the influence of government policy. Consequently, analysis of this asset shows the workings of capitalization processes more cleanly and in this respect more simply. However, these regulatory instruments are usually bound by numerous detailed rules and procedures that often have a direct bearing on the quota's value. This factor does not usually have a counterpart in land markets, making the analysis of quota values more difficult in this respect than the analysis of land values.

None of the papers surveyed argued against the present value approach to capitalization and quota values nor provided any evidence against this approach. All papers either used this approach, showed the close linkage between quota market prices and discounted values of returns, or assumed the applicability of this model. The empirical papers show that quota values tend to respond to income changes more substantially than do land prices. The questions that arise in this literature are mostly surrounding how the model is structured, how policy risk is observed or can be measured, how large is policy risk, and how such a model can be applied to different empirical situations. It is a small but rich literature that is mostly relevant to the capitalization issues being addressed in this paper.

Three recent findings in this literature are worth noting. Barichello (1999) reviewed data for his calculation of the policy risk implicit in observed milk quota values in several provinces to show that policy risk roughly halved between the early 1990s and the post-1995 period. This coincides with the signing of the Uruguay Round Agreement on

Agriculture that fixed the key parameters of domestic dairy policy of interest to dairy farmers buying quotas, arguably reducing the risk of changes in that policy. Turvey et al (2003) noted that with the commercial export program in place for Canadian dairy farmers in the late 1990s and early 2000s, the returns to milk quotas were measured by the difference between domestic prices and export prices, not marginal costs. Quota price data support this argument and reveals that the export prices was close to marginal costs, not below them as was argued in the WTO decision against Canada on export subsidies. These data also showed that the risk of holding export contracts was higher than with regular milk being sold on the domestic market. Finally, Sumner and Wilson (2005) used a unique set of quota price data to measure policy risk and compare it with measures of the more familiar portfolio risk measured in the capital asset pricing model. The comparison showed that policy risk was not only important but much larger than portfolio risk, an important result that had been predicted but never previously adequately tested.

3. Other Issues Related to Use of the Present Value Pricing Model

There are a number of additional reasons why observed asset prices might diverge from what calculated asset values might be determined or expected to be. The main reasons are discussed in the following sections.

3.1 What is the Numerator? Difficulties in calculating net returns to land

The annual return from land can be a difficult variable to compute. In perfect competition (the market organization that characterizes the part of agriculture that uses land extensively for production), total returns exactly equal total costs of production, on average, in the long run. The costs of production include the market or opportunity costs for all resources used in production, including opportunity costs of owner's labour and capital, true economic depreciation of all owned assets, and costs paid for all purchased inputs. By calculating the costs of all inputs in that way, there can be no economic profit (or loss) in cropping agriculture in long run equilibrium. Farmland at the margin would earn no economic rent above its opportunity cost in its best alternative, and inframarginal units of land would each earn its own rent, depending on its unique productivity in the use to which it is being put.

There is no easy way to calculate some of the important costs in agriculture, especially opportunity costs of owned land and labour. Typically, data series are developed that show total gross returns above variable costs or above those costs that are actually paid by the farmer during the year of production. Sometimes, an estimate of depreciation is added to the costs. By subtracting only those costs that are easy to compute, some estimate of a net margin can be calculated. This margin is sometimes called net farm income or net cash income. However, it is not a true indicator of the annual return from the farming operation.

Suppose net farm income is calculated as the difference between gross income and farm costs (excluding the opportunity costs of owned labour and land). The net farm income then can be attributed as returns to those two key inputs. But how much goes to labour and how much goes to land? If labour is valued at an average industrial wage

(what may be considered the opportunity cost for this input), the balance then would represent the return to land. However, if farmers choose to remain as farmers despite low relative returns (because they like the life style, for example), that implies that the opportunity cost of their own labour may be well below the average industrial wage. A lower opportunity cost for labour translates directly into a higher residual return to land.

The true opportunity cost for own farm labour is the minimum amount that they will accept and still remain on the farm (i.e., their supply price). There is plenty of evidence that this figure might be quite low for many farmers. In a recent survey, 90 percent of Canadian farm operators rated their standard of living as good, very good or excellent (Figure 5) despite the pervasive low incomes in the industry. If most farmers are happy with their life style, that means that the true opportunity cost of their labour may be lower than often is calculated, resulting in higher (than calculated) residual returns to land.

The point of this discussion is to demonstrate that any use of data series that arbitrarily assign opportunity costs of labour (and thus establish residual returns to land) may result in a downward bias in the estimate of annual returns to land (the numerator in the present value). If the estimated annual returns are biased downwards, then use of the formula to estimate the price of land also would be biased downward. This may explain part of the reason why land prices often appear higher than those estimated with any model using data based on collected or calculated net returns.

3.2 Prices are Determined at the Margin

The present value pricing model specifies a relationship among net farm income, real interest rate and value of the underlying asset. Nearly all empirical analyses that attempted to explain this relationship have had to rely on data collected from *average* farming operations. Although various definitions of net farm income have been used in previous studies, the data on net farm incomes that have been available for statistical analyses have been averages across a group of farmers in some area under study.

This procedure may be satisfactory if the average purchaser of farm land also was average in size and average in net income. Anecdotal evidence exists, however, that this is generally not the case. Purchasers of land and production quotas tend to be larger and more specialized producers who also tend to have net incomes that are well above average. For example, Figure 6 shows that large business-focused farms in Canada had average family incomes from farming operations of over $42,000 in 2003, very large business-focused farms had family income from farming of more than $167,000, as compared to an average family income from farming of less than $30,000.

In data from the 1995 Statistics Canada Whole Farm Data Base (AAFC, 1997), the calculated net operating income of Canadian grain and oilseed farms averaged over $31 per acre for farms that had $250,000 or more of sales whereas the net operating income for the "average" farm was just over $25 per acre. If it is true that most land is purchased by large farmers, land that produces an income stream that averages $6 per acre extra would be valued at $100 per acre more in the present value model if the real interest rate is 6 percent ($150 per acre more if the real interest rate is 4 percent). In

general, the use of average values of net returns generally would bias downwards the estimated value of land if the following two conditions hold:

i) larger than average farms have higher than average net margins per acre, and
ii) purchasers of land are disproportionately in the large size category.

3.3 Role of Off-farm Employment and Hobby Farming

A further problem for the net present value pricing model is the role of off-farm employment opportunities and hobby farming. Nowadays, modern technologies make rather large-scale extensive farming operations possible with limited labour inputs. There are many examples of modest sized farms being operated where the farm operator (and maybe even spouse) holds down full-time jobs off the farm. This permits an attractive lifestyle for certain people that are reflected in the high rate of satisfaction found in many farm surveys.

Figure 7 shows that off-farm income has been growing as a percentage of total family incomes on farms in Canada. In 2002, net farm income was only an average of $9,225 in Canada while off-farm income averaged $63,160. The share of off-farm income as a percent of total farm family income increased from 72 percent in 1980 to 87 percent in 2002 (AAFC, 2005).

The use of the present value pricing model where the numerator is based on calculated net farm incomes does not account for the large amount of purchasing power gained from off-farm employment. The average farm family income in 2003 was $64,074 (AAFC, 2005) but only the large farms ($100,000 - $500,000 total sales) and very large farms ($500,000 and over) had significant net farm incomes (Figure 8). Increasingly significant off-farm incomes do not change land productivity and rents accruing to farmland, but they do raise the ability to pay for farmland for consumption reasons. They also allow self-financing to reduce the risk and credit cost of buying farmland, and permit holding land in downturns, keeping prices higher than otherwise.

3.4 Role of the Interest Rate: Time Patterns of Real Interest Rates

An explanation of the pattern of asset prices in Canada must include some discussion of the denominator of the net present value formula as well as the numerator. This is particularly so when there has been considerable variation in real interest rates in Canada in the past fifty years (see Figure 8). This is all the more important when asset values in agriculture have increased steadily during the past two decades, particularly quota values (Tables 9 and 10). The striking observation about real interest rates is that they fell to their lowest levels since 1950 during the decade of the 1970s, peaked in the 1980s, more in the early 1980s but in 1989-90 also, and then gradually fell to current relatively low levels.

These patterns in real rates are quite clearly seen, inversely, in asset values. The rapid decline in farmland values following 1981-82 came on the heels of the rapid increase in real interest rates during 1980-81 and the sustained high rates (almost three times the average of the 1950-75 period) observed subsequently until 1990. The recent

increase in asset values during the 1990-2003 period can be interpreted as being, in part, a natural response to the decline in real interest rates that have occurred since 1990 (Table 11).

3.5 Importance of Factors Outside of Agriculture

We have already noted that non-farm factors play a role in farmland prices, especially in certain regions. However, the integration between rural and urban markets for all farm inputs, notably labour and land, has become closer over the last several decades, leading us to add more detail to this relation. First, there are close ties between real estate and bank lending, as with other forms of investment. This is why we noted the potential importance of inflation as a factor in farmland prices, reflecting the substitution in asset portfolios among land, equities and bonds. In addition, the interest rate itself mediates the competing demands of these investment categories and, as already noted, plays a critical role in farmland demand. As non-farm ownership of farmland has tended to become more common, these relations across different forms of investment within portfolios, including farmland, likely have become closer.

Economic growth in the larger economy can cause land prices to rise because the demand for real estate increases against a constrained supply of land, just as economic recession can cause the reverse. Land prices have a tendency to increase faster than the rate of economic growth because the income streams on which they are based are residuals (after all other costs have been paid). Relatively small changes (positive or negative) in aggregate demand cause proportionately greater changes (positive or negative) in firms' net margins, leading sometimes to long periods of land price inflation or deflation.

The markets for most inputs or products tend to be self-correcting: price rises will bring forth increased supply, thereby leading to lower prices. In the markets for many agricultural products, the self-correcting process may be lagged because of the biological time demands required to increase production. Thus, hog price cycles tend to be 3-4 years in length and beef price cycles tend to be 10-12 years in length. However, the self-correcting process in the land market can be much longer. Owners may hold land off the market when land rents turn down, preferring to await rescue by either an upturn in rents or improved economic conditions that tend to increase the prices of all real estate.

This process is further exacerbated by speculative behaviour of some investors in the land market. This is the source of the literature on booms (bubbles) and busts in land prices that was noted above. Some may have little or no interest in using the land productively, preferring to wait for increases in its value. Since the price of most farmland has had a long term upward trend (although not in real terms since the early-mid 1980s), this often has been a successful strategy. This is especially true in areas close to major urban areas where agricultural land continuously is tapped for industrial or municipal use.

3.6 Summary of Issues Related to Use of the Present Value Pricing Model

The Present Value Pricing Model has been criticized by some because it has not always explained well the observed changes in land prices. We argue that there are a number of theoretical and empirical issues that make explanation of farmland prices inherently difficult. First, the most basic version of the Present Value Pricing Model specifies a relationship among net farm income, real rate of interest and value of the underlying asset. In agriculture, there is no easy way to accurately calculate net farm income since the cost of some inputs (principally land and owner's labour) must be imputed. Thus any use of net farm income from a data series corrupts (to some extent) the use of any model that relies on farm returns from investment on an asset. Second, the model in its more complete form includes other explanatory factors. Principal among these is a set of risk factors, notably policy risk, as well as trends in future net returns, embodied in expected future capital gains of the quota. There is also a set of other returns on the farm such as tax benefits from owning the quota. Third, purchasing decisions are made at the margin, not at the average. It is well-documented that most individuals who purchase land are larger and more specialized producers who tend to have net incomes that are well above the average level that is recorded in any set of data.

Fourth, modern technologies have made off-farm employment and hobby farming attractive opportunities for many in recent years. Many people in these categories are able and willing to pay much more for select tracts of land than the net incomes produced on those properties would seem to justify. Fifth, real interest rates have fallen to very low levels and it is not easy to estimate purchasers' expectations of future real rates of interest. Sixth, we know that a number of factors outside of agriculture can play a role in the price of farmland. The rural and urban markets for many farm inputs (including labour and capital) are much more integrated than they were in the past. Some investors include farmland as one class of asset in their investment portfolios. Thus, farmland prices are not immune from developments that take place in other sectors of the economy, such as in the housing and bond markets.

The simplest version of the Present Value Pricing Model cannot be expected to account for all these added variables and factors, some of which are not measurable. As long as these difficulties are well-understood, the model can still be used to provide important analyses of changes in the values of assets, including those of agricultural land and marketing quotas.

4. Examining the Data

We now turn to selected time series data to apply this background in capitalization research with the objective of interpreting recent trends and offering insights as to these developments.

4.1 Net Farm Income Patterns: What has Really Been Happening?

The data in Figures 1, 2, and 3 illustrate a key problem facing policy makers and researchers: carefully selected data can be made to support different points of view. The

data in Figure 1 picks the most extreme end points in at least 44 years, from an unusually high level of real farm income in the mid-1970s period to the lowest-ever year in 2003. This can be seen in Figure 2 where the data run from 1961 to 2003. The result of choosing years such as those in the mid 1970s is to bias the trend toward much greater rates of decline.

To calculate an accurate and representative typical long run trend requires the use of less year-specific values for ending points, such as three-year moving averages, or a longer time period. If we take only a slightly different time period, from 1971 to 2004, and use three-year moving averages, the results show that the 2002-2004 average net farm income has declined by only 25 percent in real terms from the 1971-73 level. This is equivalent to an annual decline of 0.95 percent per year. The disadvantage of this series is that the most recent end-point includes the unusually low net income year of 2003 (reflecting the BSE-induced dramatic drop in beef sector income) which would bias the decline upward.

A measure of decline that is arguably more accurate and clearly less dependent on a particular endpoint would be to run a linear regression on net income using a time trend to explain measure the rate of decline. If we were to do this, we can also acknowledge the unusual nature of the 1974-76 high income years with a dummy variable and similarly the unusually low income year of 2003. When we do this the result is very similar to that arrived at with 3-year moving averages above. The average rate of change in net farm income is 1.1 percent per year and this is statistically significant at conventional levels.[6] In either case, the result is in substantial contrast with the impression of dramatic net farm income decline given in the Farm Income Issues Source Book, published in February 2005 by AAFC.

Finally, we can vary the time period under examination. If we look at the longer period from 1960 to 2004 the results are even more at odds with the report of substantial decline described in the AAFC Source Book. Using the same regression as that described above we find that although the dummy variables are largely all significant as before, this time the time trend is not. It shows a coefficient that is relatively close to zero (less than 0.2 percent per year, and a *positive* value) and this is statistically insignificant. In other words, this regression shows there is *no trend* to the time pattern of net farm income, or that the rate of change is 0 percent. This underlines our initial observation, that when we look at the net farm income data in a longer run context, without giving undue influence to the beginning and ending points of the time period, the rate of decline in real net farm income is at most 1 percent per year over thirty years, and there is no decline over a time frame of 40 years. If we look at the trend over a more recent and shorter time period, from 1990 to 2003, to conform to the land price data discussed above, the rate of decline is almost identical to that reported for the 1970-2004 period, 0.93 percent per year. Our overall conclusion is that over all three time periods examined, the data show modest, between 0 and 1 percent per year, annual declines in aggregate real net farm income while real land prices are rising, at least over the 1990s to date, at 2 percent per year.

[6] This same result is arrived at whether the regression in run arithmetically or in logarithms. In both cases the time trend plus the dummy variable explain almost 70 percent of the variation in net income.

4.2 Have capital values in Canadian agriculture been increasing?

Figure 4 shows the total amount of farm capital in real terms in Canada, broken down into its components. It shows that farm capital is heavily dominated by land and buildings. Further, the real value peaked in the 1979-81 period, whether you look at total farm capital or only at land and buildings. Capital (really land and buildings) values fell until the late 1980s, since then they have slowly increased to current levels. There is no evidence of any dramatic change or bubble in land or capital values since the early 1980s, although the 1979-81 peak in land and capital values clearly was unusual and, in retrospect, unsustainable.

Figure 10 shows that the increase in aggregate quota values has been much more dramatic in real terms than has been the increase in land and buildings, or the total of non-quota farm capital. It has increased steadily in value since the first year for which aggregate data are available, and the pace of increase has quickened sharply since the mid-1990s. In the aggregate there is no clear sign of abatement of this rise. Also, because the total quantity of quota has grown very slowly, the pattern of Figure 4 can be taken as a rough indicator of the growth in unit quota prices. However, when we add the total value of quotas to the total value of other farm capital, shown in Figure 4, the effect is relatively small, although growing. The total value of farm capital excluding quota was roughly $200 billion in 2003, while the value of quota was about $25 billion. Quota now accounts for about 1/8 of the total value of farm capital in Canada including quota values. Even with quota values included, the current real value of farm capital is still below its 1980 peak.

When the real value of farm land and buildings are placed on a per acre basis, as shown in Figure 12, the time series pattern is not fundamentally different from the aggregate value of land and buildings in Figure 9. Land prices peaked in 1981 at a Canada-wide average of $1100/acre, in 2003 dollars. These prices gradually have increased since their post-1981 trough in 1988 so that by 2003 they had reached $900/acre, also in 2003 dollars. Figure 12 shows how gradual the growth in land prices has been compared to the growth in quota values. To give some quantification to these two different patterns, since 1990, for an arbitrary comparison point past the 1980s decline in land prices, real land prices have risen at a compound growth rate of 2.0 percent per year. Real (aggregate) quota values have grown at a compound annual rate of 7.7 percent per year, almost four times faster. This latter rate of asset value growth is not often observed over such a lengthy time period.

4.3 Has farm debt (relative to net farm income) been increasing?

The final figure to examine is Fig 14. It shows the ratio of total farm debt to net farm income. These data run from 1971 to 2003 and show, after 1974, a more or less steady increase in the ratio. The ratio does shoot upward somewhat in the last two years of data which is a reflection of the large fall in net farm income in those years. But still, the ratio is only slightly above the general upward trend. This trend, by itself, is not alarming. It shows that farms are being financed more by debt and less by equity. However, the level of equity has been historically high in agriculture. Further, if this debt is being taken on by the larger farms whose net farm income has been increasing over the

last decade, this may be economically sustainable and not surprising. In terms of its effect on capitalization and land prices, we know from the empirical work reviewed earlier that there is no close relationship.

4.4 What factors explain rising land prices in the 1990s?

This section of the report examines what might be occurring in the land market to explain how land prices can be rising when aggregate net farm income has been declining (albeit, rather slowly over time). A number of factors can be seen to be playing a role.

First, expected net returns are known to be critical, and may be different from aggregate net farm income data for those farmers who are doing the land buying. Their view of higher expected returns may be due to their own economies of size, their ability to use newer technologies that cut their costs or increase their yields, or their ability to sell into higher priced markets. Any of these optimistic projections of future profitability would lead to higher prices for land than would seem justified on the basis of past returns.

Second, using average net farm income to explain land price is problematic because land typically is purchased not by average farmers but by farmers that are larger than average. Consider the data in Figure 15 where net farm income data has been restricted to only those farms with gross sales (receipts) of $10,000 or more. This is hardly a large farm, but it does remove some of the smaller hobby farms from the data. Even this change shows different results for net farm income. Relying on census data for such disaggregation we see from this Figure that average real net farm income declined from 1981 to 1991, but has risen since then in both subsequent intercensal periods. From 1991 to 2001, average net farm income rose by at least 40 percent, or by 3.5 percent per year in real terms. Ideally, one should look at even larger farms because $10,000 in annual sales cannot be considered a serious income earning operation. The actual net farm incomes of very large business-focused farms in Figure 6 (the ones who purchase most of the land sold in a given year) are more than 7 times the average. This certainly helps to explain why observed land prices seem higher than what would be expected on the basis of average net farm incomes.

Third, farmers may expect government payments or related benefits to be increased in coming years, at least in part to compensate for any poor market returns. Figure 16 shows how those payments have grown quite substantially in the last five years, at least in Saskatchewan. It might be quite rational, if you expected those returns to continue, to buy land or pay more for any land purchases.

Fourth, along with the increase in government payments, there may be an expectation that the risk of a reduction in those payments is diminishing, even if payments have not increased. In other words, if there is a belief that the risk of a change in policy to reduce government payments is falling (that government payments are becoming more secure and more likely), that will lower the discount rate in an asset purchase decision and raise the price a buyer is willing to pay. This is already suggested as a plausible reason why quota values have increased substantially since the Uruguay Round Agreement has been implemented. In some cases, this point may be empirically undistinguishable from a decline in real interest rates, although there is some independent

evidence that the risk associated with milk quotas fell in the late 1990s (Barichello, 1999).

Fifth, there is a possibility of increased off-farm returns, raising expectations of future returns from urban development or an urban-related increase in future land prices (a capital gains expectation). This may not apply uniformly across Canada, but is a plausible argument in areas near urban development like Ontario and southern BC. Rising off-farm incomes of farm families may also lower effective interest rates if they allow self-financed land purchases or may simply allow for increased land demand for consumption reasons. This may apply to only some farm families across the country but for those individuals it may lead to increases in the bid prices of agricultural land over what would seem prudent based only on calculated net farm income.

A sixth factor for the increases in land prices relates to changes in the real rate of interest. These are shown in Figure 8, where what is striking is the jump in real rates that occurred in the 1979-80 period, preceded by declining rates in the period from 1960 to 1975, and followed by historically very high real rates throughout the 1980s. The period since 1990 to date shows declining real rates. These rate patterns are important to consider in addition to the net income patterns just discussed. Land prices reflect both net incomes to land as well as interest rates used to discount those returns; however they are expected to move into the future. These rates, on a casual review, show a striking inverse relation to the actual pattern of farmland prices. Prices of farm land (in real terms) rose to historic highs in the late 1970s following historical low real interest rates. Then as real rates spiked, land prices fell. The fall in land prices continued as real interest rates remained high in the 1980s but land prices have increased during the 1990s as real interest rates have declined.

4.5 Summary of the Evidence

A large amount of publicity has created an impression that net farm incomes in Canada have fallen precipitously in recent years and the rate of decline has been increasing. Since net farm incomes are highly variable year-over-year, it is possible to show a major decline if selected high income years (particularly in the mid-1970s) are used as the starting point of the series with selected low income years (particularly the very low income year of 2003) as the end of the series. However, a careful analysis of net farm income data (in real terms) over the long term reveals that, although net farm income can be measured to show a downward trend, the rate of decline has been modest, about one percent per year.

The notion of rapidly increasing aggregate capital values in Canadian agriculture also is dispelled by careful examination of the data. Certainly, the value of production quotas in the supply managed sectors has shown a rapid increase in recent years. However, there is no evidence of rapid growth in the value of farm land and buildings. Even with the inclusion of production quota values, the current real value of farm capital in Canada is below its level of 25 years ago.

The ratio of farm debt to net farm income has slowly but steadily increased since 1974, reflecting an increase in debt, rather than equity, financing of farms in Canada. An

up tick in this ratio in the last couple years reflects the exceptionally low net farm incomes rather than any major increases in debt. With the exception of the last couple years, the level of equity in primary farming in Canada remains high and should not be a major cause for concern on an aggregate basis.

Land prices have been rising slowly from their troughs in the early 1980s. A number of factors (related to the present value pricing model) explain why this has been occurring. Although we must use observed levels of net farm incomes to conduct economic and financial analyses, farmers who purchase land really use expected net incomes in their calculations (and these numbers are not observable). Most purchasers of land tend to use newer technologies that yield economies of size or increase their yields that may result in higher expected incomes than are revealed in any historical set of average net income data. Most farmers who purchase land have larger enterprises than average. In recent taxfiler data, very large business-focused farms had net farm incomes that were more than seven times the level of the average net farm income. In addition, other unobservable variables, including expectations of increased government payments, increased off-farm income opportunities, and expectations of reduced levels of real rates of interest contribute to higher levels of land prices than might be calculated by using only historical and average data in the present value pricing model.

5. Summary and Conclusions

The price of agricultural land in Canada has continued to increase at the same time that aggregate net farm incomes have trended downward. Improved efficiency in production of most agricultural products has led to continued decreases in average costs of production. In an industry that predominantly is characterized by perfect competition, any reduction in costs must either be accompanied by a reduction in product price or by an increase in the price of that input that is most inelastic in supply, usually land. This is the only way that long term economic profits in the industry will return to zero.

There have been many attempts to better understand price movements in the land market. The net present value pricing model calculates the value of an asset as a function of the annual stream of net returns it generates and a real discount rate. Many empirical studies have used variations of this model to describe or predict changes in agricultural land prices. Most studies have found statistical support for the present value pricing model in its general form– factors that increased net returns (including subsidies) or lowered the real rate of interest (including government subsidies in their lending programs) appear to be associated with increased land prices. However, many authors bemoaned the fact that their model still left unexplained plenty of variability on land prices.

This study has shown that there are problems in using a too-simple version of the net present value model in empirical studies of land prices. First, there is a theoretical problem with definition of the numerator. There is no completely suitable method of deriving the net return from an agricultural operation when two (or more) major inputs are not purchased in the market place. In the case of agriculture, the opportunity cost of owned labour may be low because such a high proportion of those engaged in the

industry have a preference for the lifestyle and seem unprepared to exit the industry despite long periods of low returns. This means that the annual returns to the land resource might well be higher than usually are calculated (after valuing labour cost at some off-farm equivalent).

Second, it is well known that the main purchasers of farm land and production quotas tend to be those who are either larger in scale or more efficient in production. These are producers who have higher net returns than show up in most data that are based on an average of all farm operations. If the present value models in the empirical studies had used the "correct data," their performance likely would have been improved. Third, there are risk factors that are important and should be included.

Unquestionably, the present value model can explain a great deal about movements in the prices of agricultural land and production quotas. However, the very nature of these two inputs (both of which in the aggregate are very inelastic in supply) has led during some periods to speculation in their prices. General economic conditions, including the prices of other forms of real estate (houses, office buildings), have an influence on the prices of agricultural land and production quotas. The agricultural economy is much more closely integrated with the regular economy than it used to be, especially in the labour market. Part-time farmers, hobby farmers, speculators eyeing the future growth of urban areas, and actions of many others have meant that financial conditions in the relatively narrow agricultural production industry have become much less important in the final determination of land prices.

Finally, when it comes to explaining why land prices are going up while net farm income appears to be declining, there are a number of important factors that may explain or at least be consistent with these observations. Net farm income has fallen less than some commentators claim. The net farm income data in the aggregate may be inappropriate to reflect incomes of actual asset buyers. Real interest rates have declined. There is the possibility of government payments offsetting market price declines. The risk of government programs being ended or payment falling may be declining. And there may be non-farm financial returns to land that are climbing and off-farm incomes that are also climbing. All these factors are consistent with increased land prices for given published net farm income data, exactly as we have observed.

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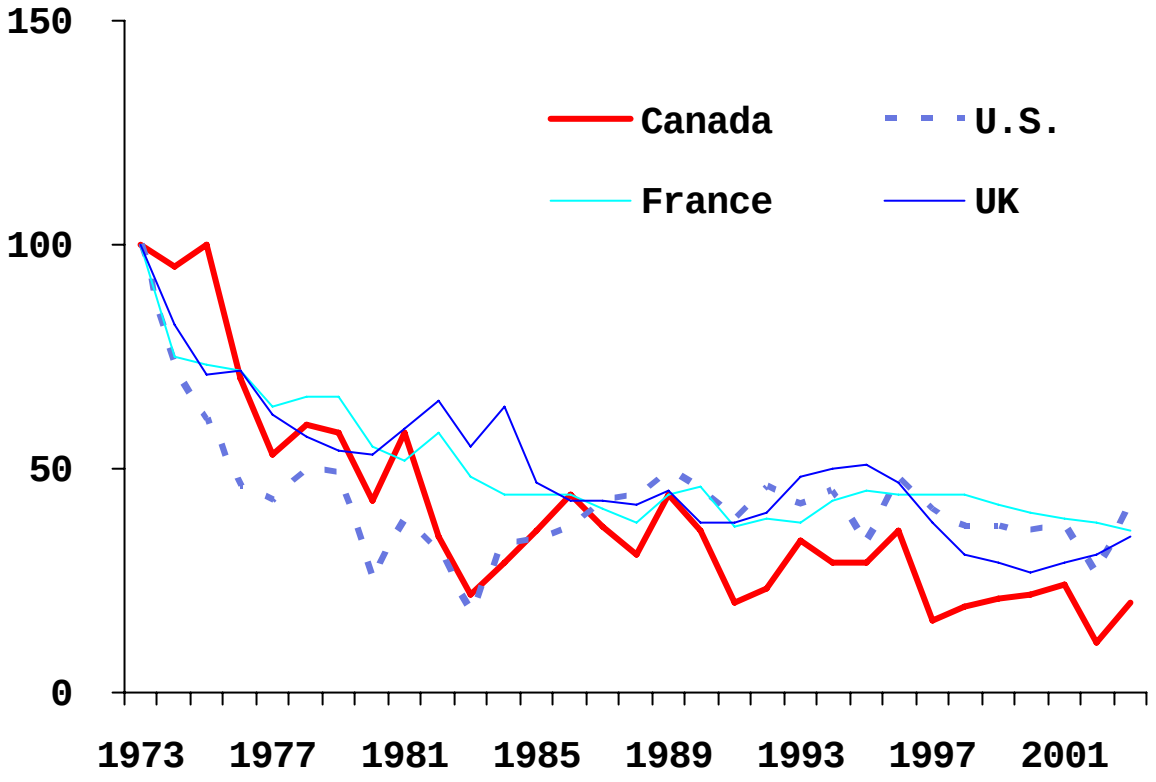

Figure 1. Total Net Farm Income in Canada, the United States, France and the United Kingdom, 1973-2003. (Source AAFC 2005)

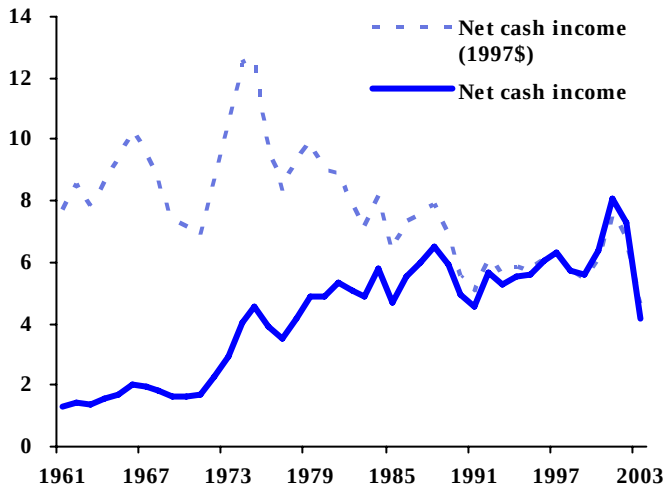

Figure 2. Net Cash Farm Income in Canada (Nominal and Real Terms) 1961 – 2003. (Source: AAFC 2005)

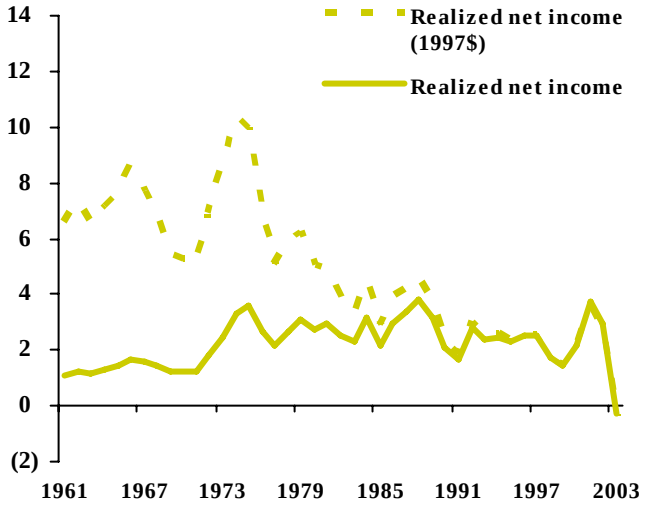

Figure 3. Realized Net Farm Income in Canada 1961-2003. (Source AAFC 2005)

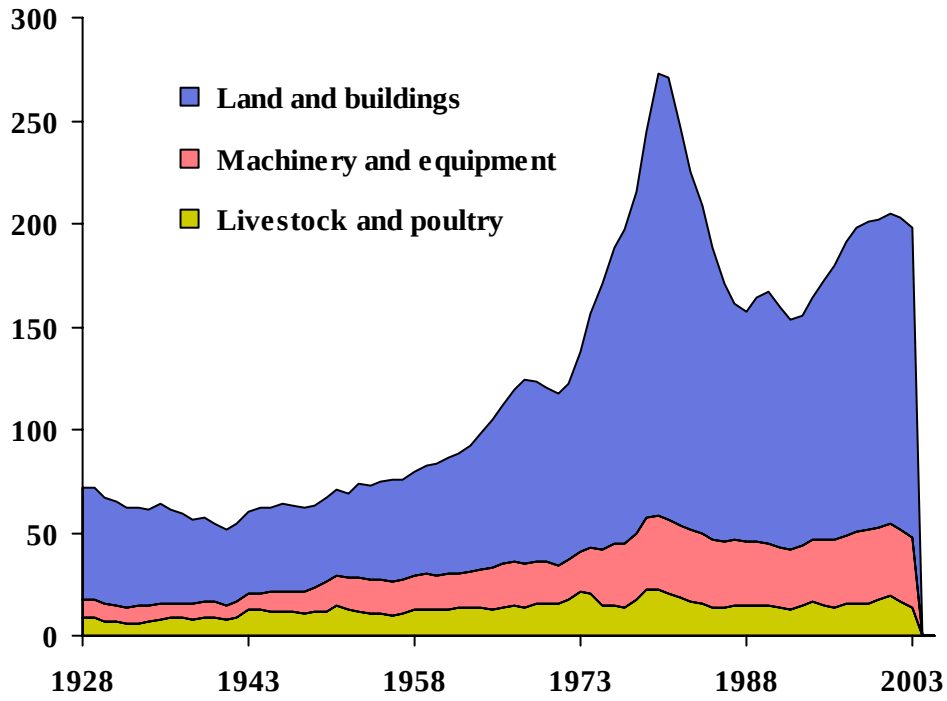

Figure 4. Total Value of Farm Assets in Canada (2003 dollars), 1928 - 2003. (Source: AAFC 2005)

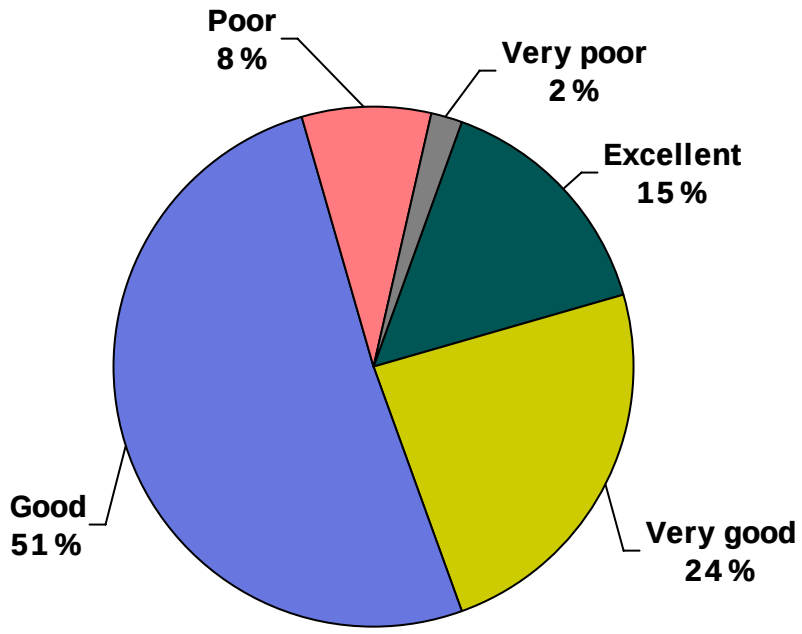

Figure 5. Standard of Living Rating of Canadian Farm Operators, Spring 2003. (Source: AAFC 2003)

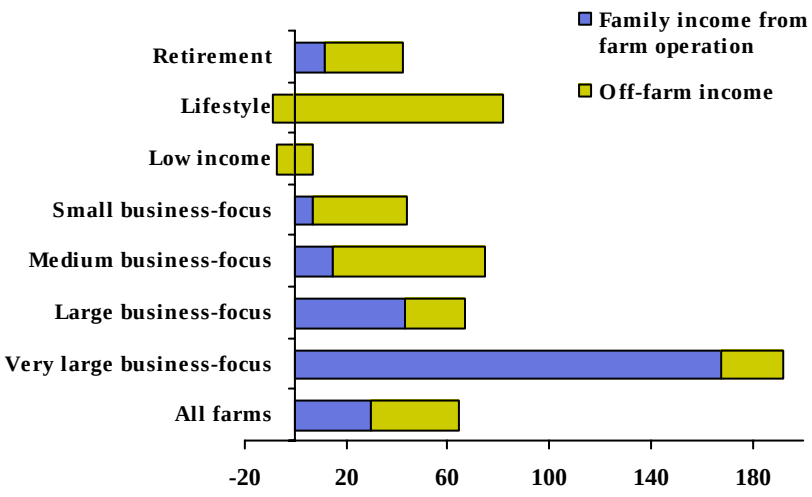

Figure 6. Total Farm Family Income in Canada by Type of Farm, 2003. (Source: AAFC 2005)

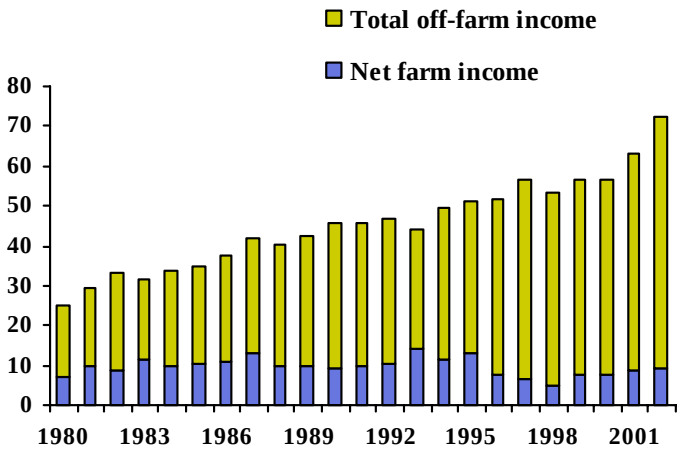

Figure 7. Income of Farm Families by Source in Canada, 1980 - 2002. (Source: AAFC 2005)

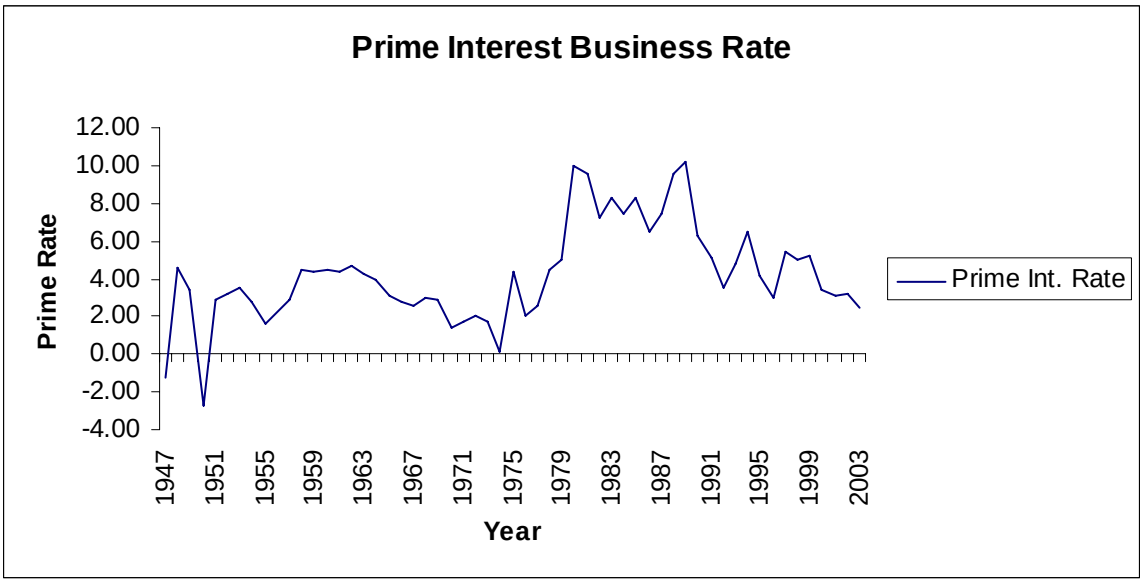

Figure 8. Prime Business Administered Interest Rates (2003=100)

Source: Bank of Canada, Department of Monetary and Financial Analysis.
* The prime business loan rate is the interest rate charged to the most credit-worthy borrowers. For deflator the Implicit GDP Price Deflator was used.

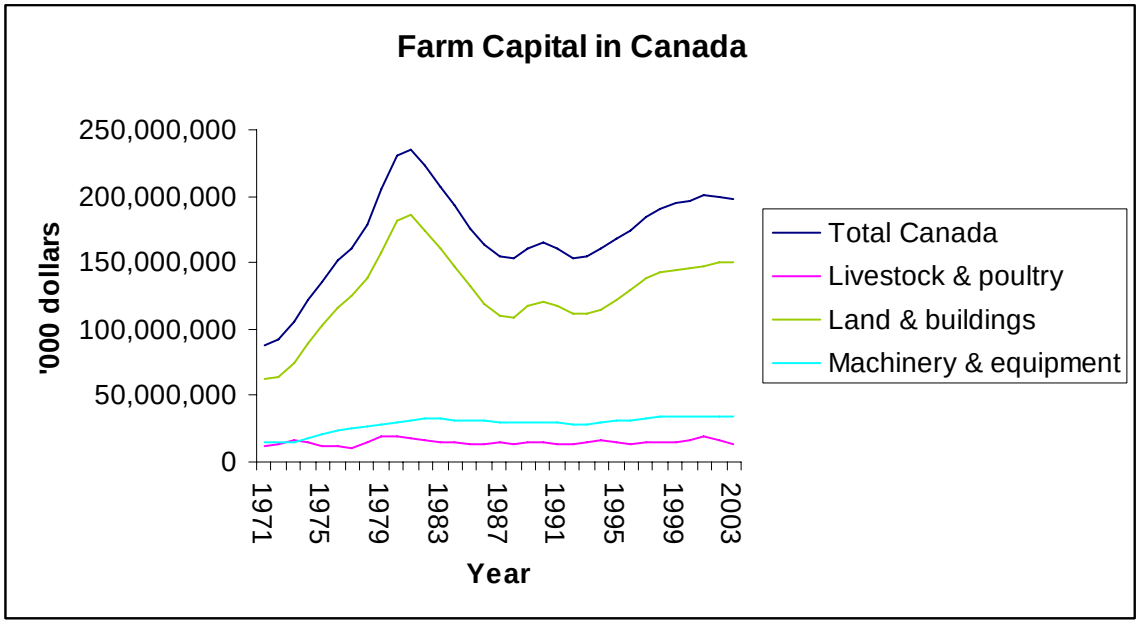

Figure 9. Value of Farm Capital (2003=100)

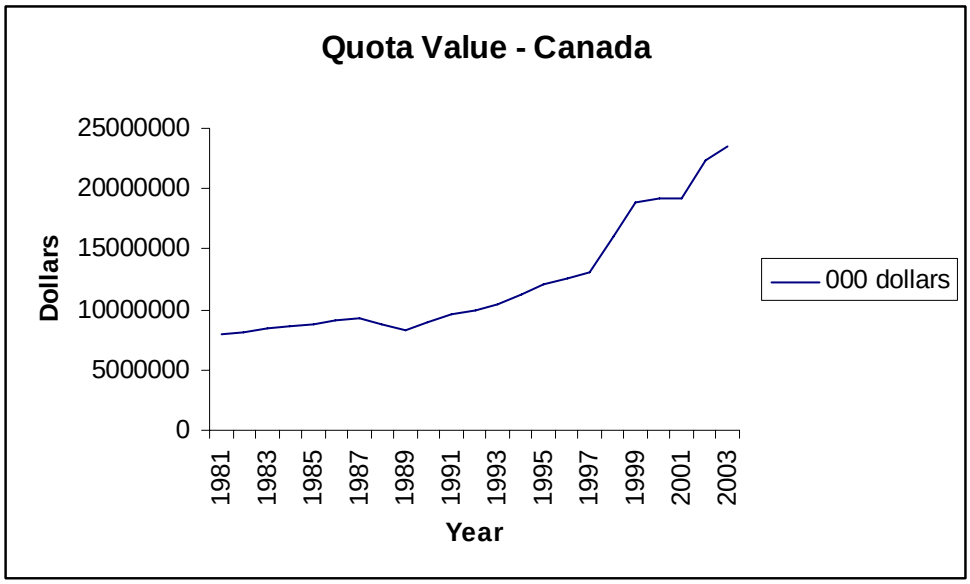

Figure 10. Value of Quota for Canada (2003=100)

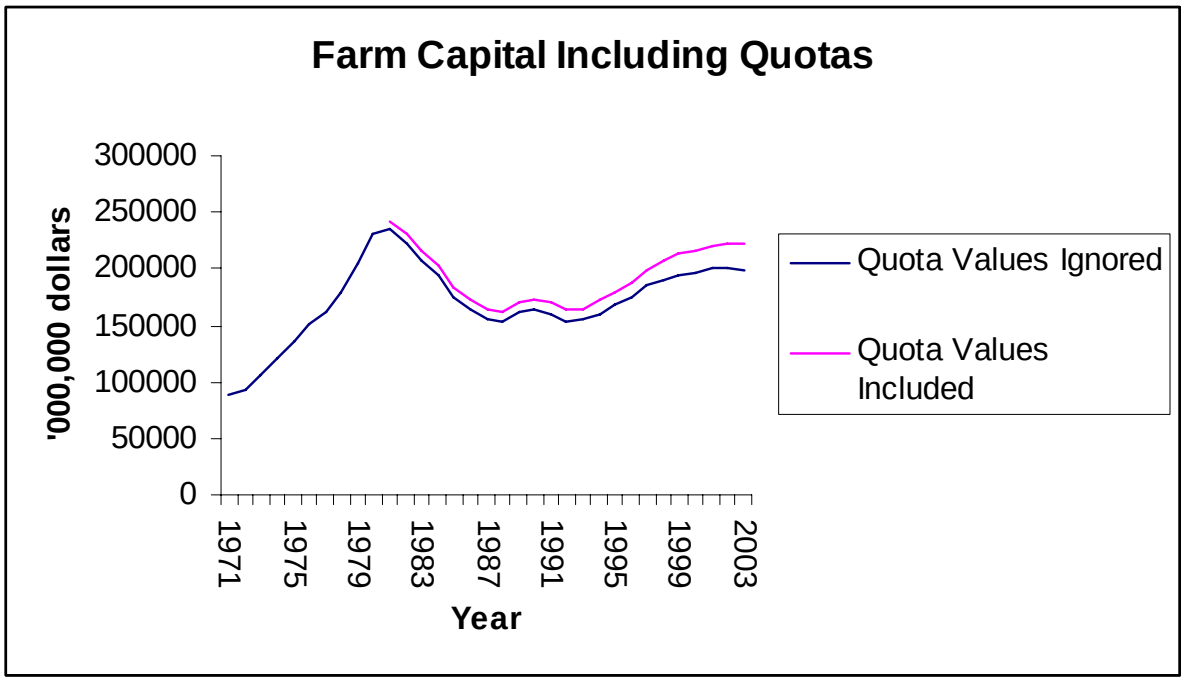

Figure 11. Comparison of Farm Capital including and excluding quota values.

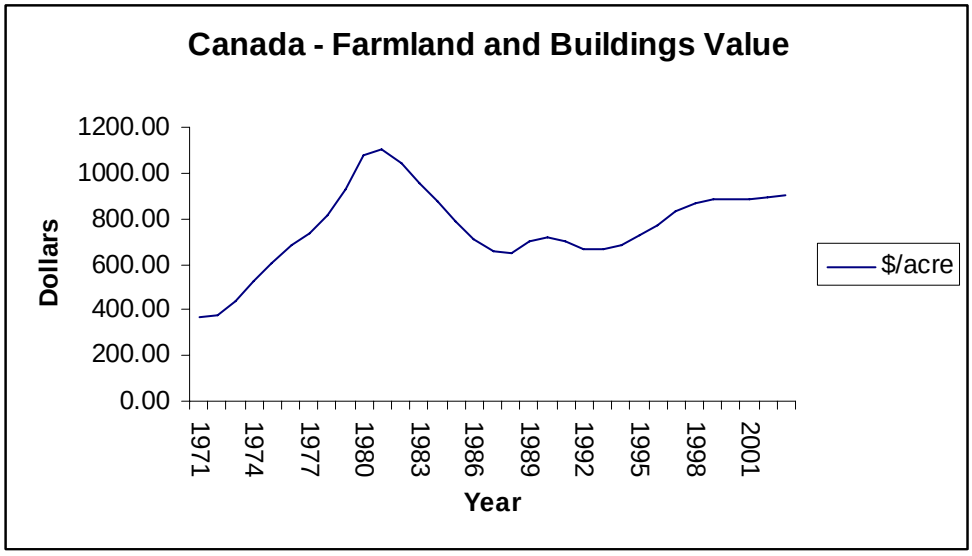

Figure 12. Value per acre of farmland and buildings in Canada (2003=100)

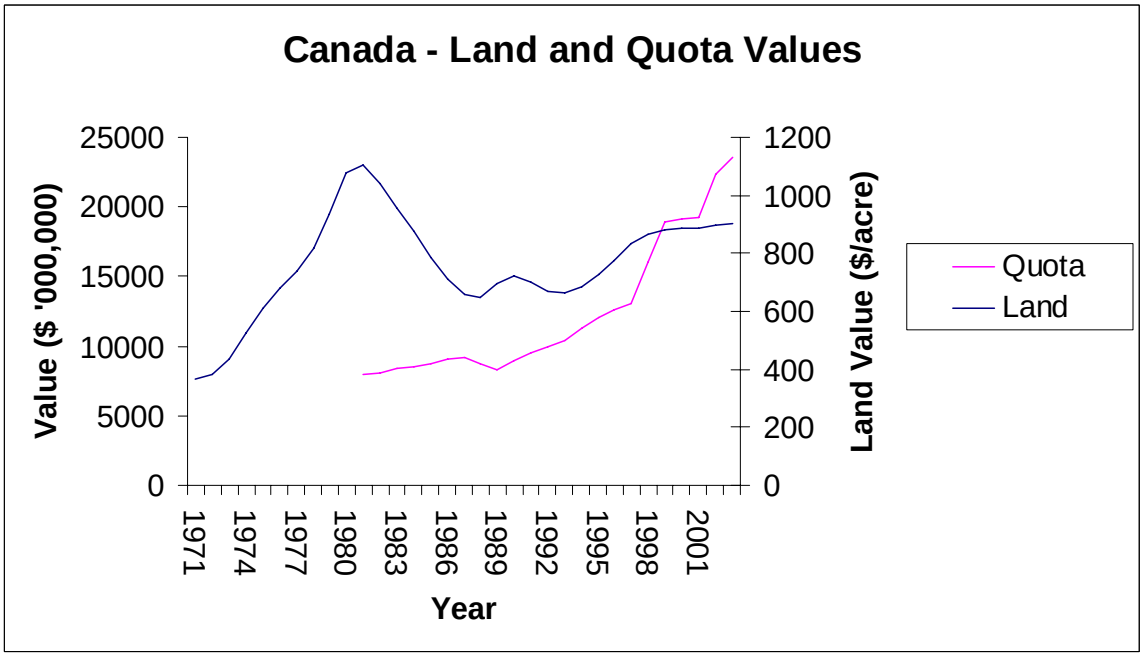

Figure 13. Value of total agricultural farm land and buildings and quota values for Canada (2003=100).

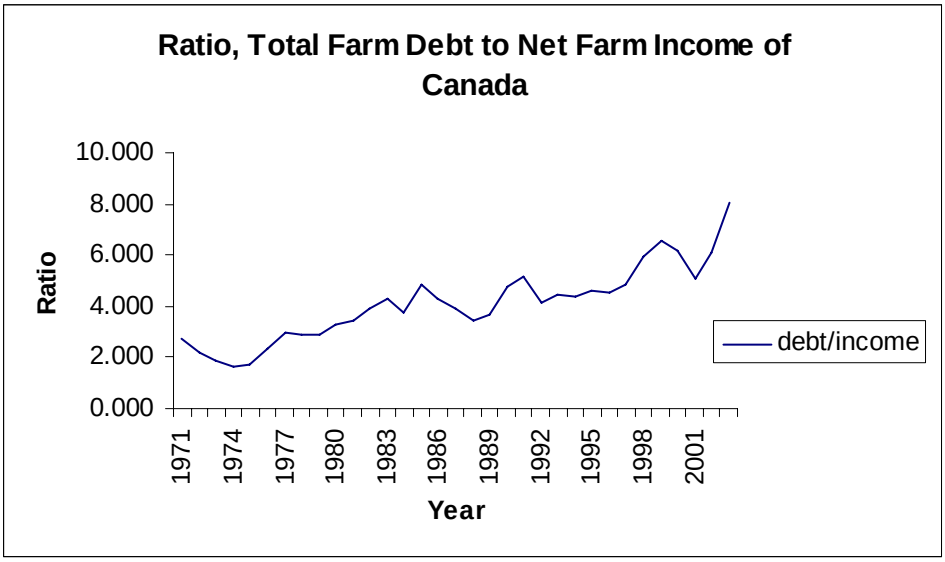

Figure 14. Ratio of Total Farm Debt to Total Net Farm Income – Canada

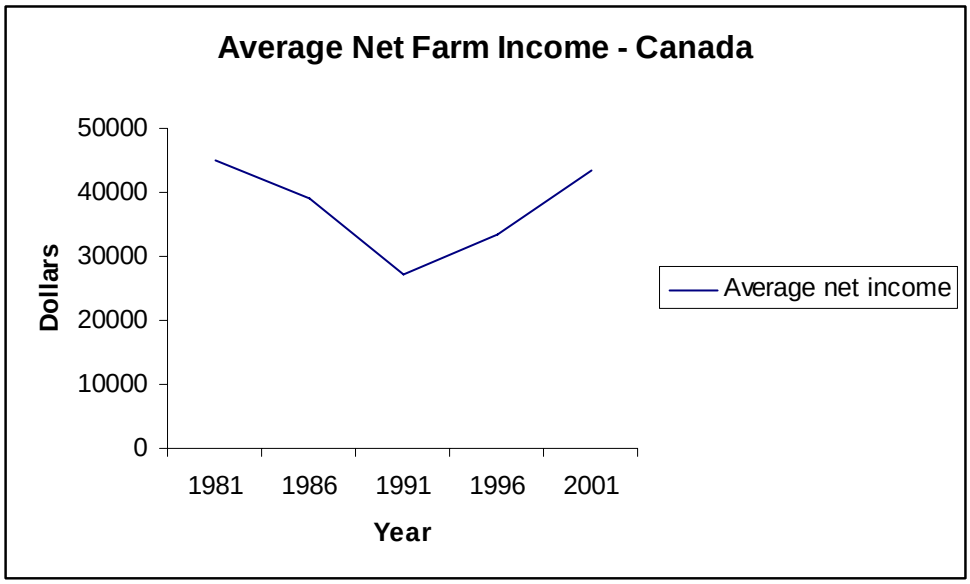

Figure 15. Average Net farm income in Canada (2003=100), receipts >$10,000. Data only for census years.

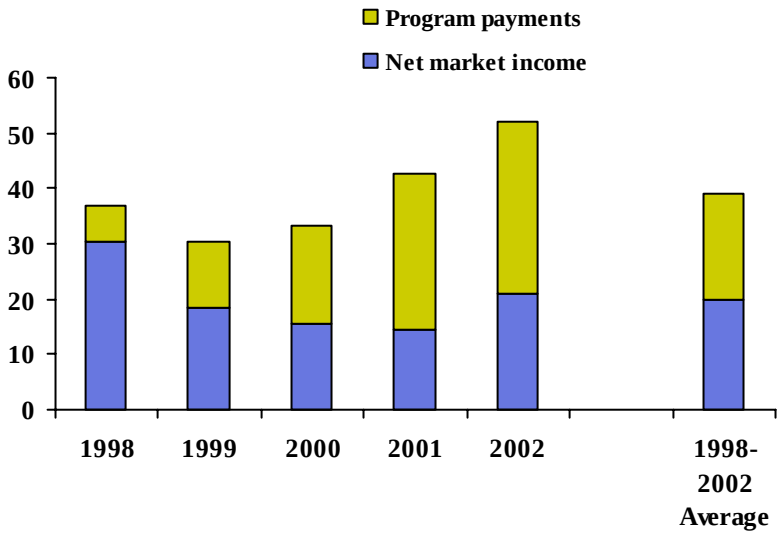

Fig 16: Net Cash Incomes of Saskatchewan Grains and Oilseeds Farms With Gross Revenues Between $100,000 and $250,000 (Top 20% of Farms)